

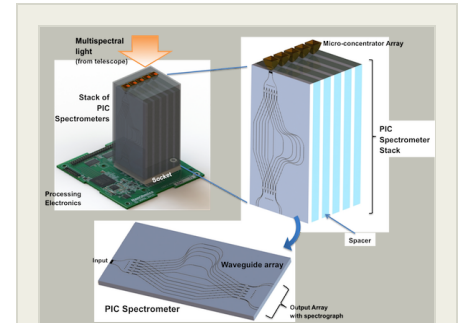
Photonic IC Spectrometer for Spacecraft, Phase I

Completed Technology Project (2016 - 2017)



Project Introduction

CubeSat/SmallSat bus infrastructure imposes stringent mass, power, footprint, and volume constraints on science instruments such as spectrometers. Nanohmics, Inc., proposes teaming with researchers at the Catholic University of America (CUA) to develop a real-time spectrometer that demonstrates photonic integrated circuit (IC) interferometric capabilities for the first time in the MWIR spectral band, and achieves extremely low size, weight and power (SWaP). The Nanohmics/CUA team proposes in Phase I to design and fabricate a proof of concept (PoC) photonic IC spectrometer operating in the MWIR, with TRL 3. Laboratory testing of the Phase I photonic IC device will strengthen the scaled-up photonic IC spectrometer prototype design for Phase II. The CUA research partner will perform finite-difference time-domain (FDTD) modeling and simulation. In Phase II, the team will fabricate and test the scaled-up photonic IC spectrometer prototype, achieving TRL 6. The photonic IC spectrometer uses an array of interferometers that are microfabricated on the IC to output a real-time spatial interference pattern that is similar to the spectrograph obtained via time-scanning in Fourier transform spectroscopy (FTS) such as Fourier transform spectroscopy (FTIR). However, the photonic IC spectrograph is instantaneous and obtained by an instrument with no moving parts, similar to a class of devices called a spatial heterodyne spectrometer (SHS). A stack of photonic IC spectrometers acts as a one-dimensional (1D) imaging array and performs hyperspectral imaging for remote sensing and other applications. Wavelengths in the MWIR range ($\sim 3\text{--}5$ micrometers) will allow the use of common microfabrication techniques and materials, which will keep costs low. Our expertise in developing planar waveguide structures places Nanohmics in a unique position for fabricating photonic IC spectrometers.



Photonic IC Spectrometer for Spacecraft, Phase I

Table of Contents

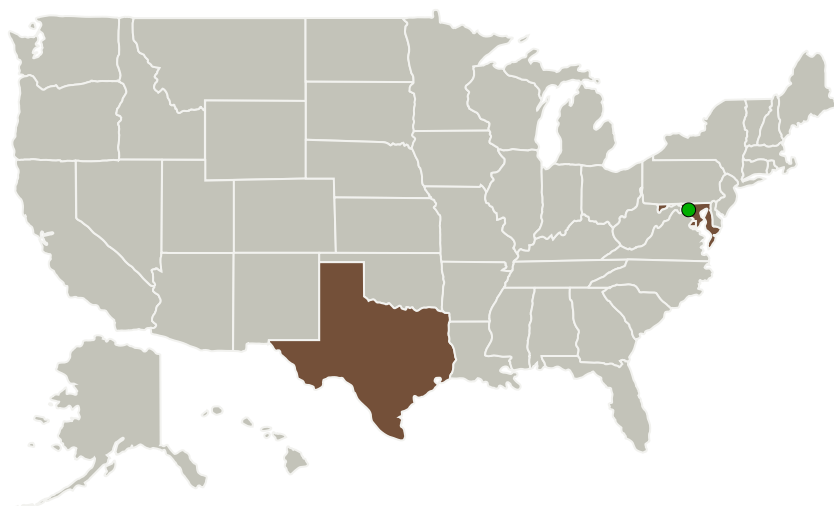
Project Introduction	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Technology Areas	3
Target Destinations	3

Photonic IC Spectrometer for Spacecraft, Phase I

Completed Technology Project (2016 - 2017)



Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Nanohmics, Inc.	Lead Organization	Industry	Austin, Texas
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland
The Catholic University of America(CUA)	Supporting Organization	Academia	Washington, District of Columbia

Primary U.S. Work Locations	
District of Columbia	Maryland
Texas	

Project Transitions

▶ **June 2016:** Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Nanohmics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

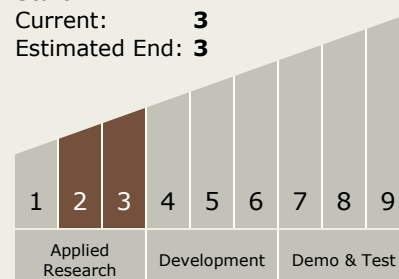
Carlos Torrez

Principal Investigator:

Mark Lucente

Technology Maturity (TRL)

Start: 2
Current: 3
Estimated End: 3



Photonic IC Spectrometer for Spacecraft, Phase I

Completed Technology Project (2016 - 2017)

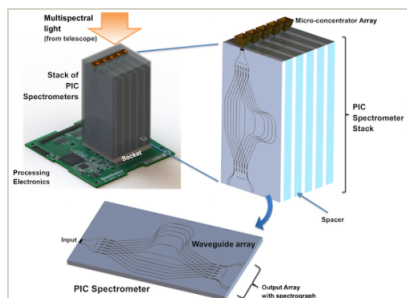


✓ **June 2017:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140037>)

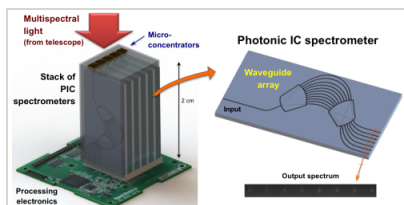
Images



Briefing Chart Image

Photonic IC Spectrometer for Spacecraft, Phase I

(<https://techport.nasa.gov/image/128652>)



Final Summary Chart Image

Photonic IC Spectrometer for Spacecraft, Phase I Project Image
(<https://techport.nasa.gov/image/128582>)

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.3 Optical Components

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System